

Connect the output of each proponent-supplied modulator (main channel and augmentation channel, if provided) to an individual RF Combiner. Connect the output of the RF impulse noise generator, through a splitter and band-pass filters, to the other input port of both combiners. Connect the outputs of the combiners to the proponent-supplied demodulators.

Select a flat-field test signal. Set the amplitude of the flat field to 350 mV or 50-percent of peak white.

19.1.2.3.3 Measurement Technique

With the output of the impulse noise generator fully attenuated, adjust the ATV carrier level 2 dB above the level at which receiver-generated noise is just perceptible. Then, restore the impulse noise to the calibrated power level. Adjust the level of the impulse noise, up or down, to the just-perceptible level. The difference between this just-perceptible level and the calibrated level is the desired data from this procedure.

19.1.2.3.4 Presentation of Data

Log the ATV carrier level, the calibrated impulse noise level, and the difference (in \pm dB) between this calibrated noise level and the just-perceptible level for the system under test. Record the output of the SUT on the HD-DVTR, and photograph the ATV picture monitor, at the calibrated noise level and over a range of levels determined by the expert observers in accordance with the ranging procedure described in the Subjective Test Procedures Manual.

19.1.3 Side Panel/ Center Area Differential Noise Susceptibility

19.1.3.1 Introduction

The following procedure applies to augmented-NTSC systems only. These systems may transmit side panel information through a separate, or augmentation, channel from the one used for the center, NTSC-compatible, area of the picture. In this case, the picture impairments due to noise in the transmission path may differ between the side panels and the center area. The procedure of Section 19.1.1 has determined the absolute noise

perceptibility in each channel independently. The procedure described below will establish the differential noise perceptibility between the two channels.

The differential noise level between the side panels and the center area, for the seam joining them to remain imperceptible, depends upon the absolute noise level. The lower the overall noise level, the closer the noise level in the two channels must track each other. At higher noise levels, the seams are masked by the noise.

19.1.3.2 Test and Measurement Equipment

The equipment is the same as that specified above in Section 19.1.1.2, except that no NTSC equipment is used in this procedure. A splitter and an additional attenuator for the noise are required, so that different levels of noise can be applied to the two channels.

19.1.3.3 Procedure

19.1.3.3.1 Setup

The setup for this procedure is the same as that described in Section 19.1.1.3.1, with one modification regarding the connection of the noise source. Connect the output of the noise source, through a splitter, to two attenuators. Connect the output of one attenuator to an RF Combiner, the other input of which receives the output the main channel modulator. Connect the output of the other attenuator to a second RF Combiner, the output of which receives the output of the augmentation channel modulator. The two combiners drive the respective channel demodulators, with provisions for measuring the RMS power at the demodulator inputs.

19.1.3.3.2 Measurement Technique

Adjust the C/N_0 of each channel to the level determined by the expert observers to be just perceptible. These levels were found in the procedure of Section 19.1.1.3.2. Measure the noise level in each channel by maximally attenuating the modulator output to the RF combiner, and reading the noise power indicated on the RMS power meter. Then, measure the signal by restoring the modulator output to its initial level, and setting the noise attenuator for maximum attenuation. Read the signal power using the method specified by the proponent. This gives the C/N_0 at threshold for each channel.

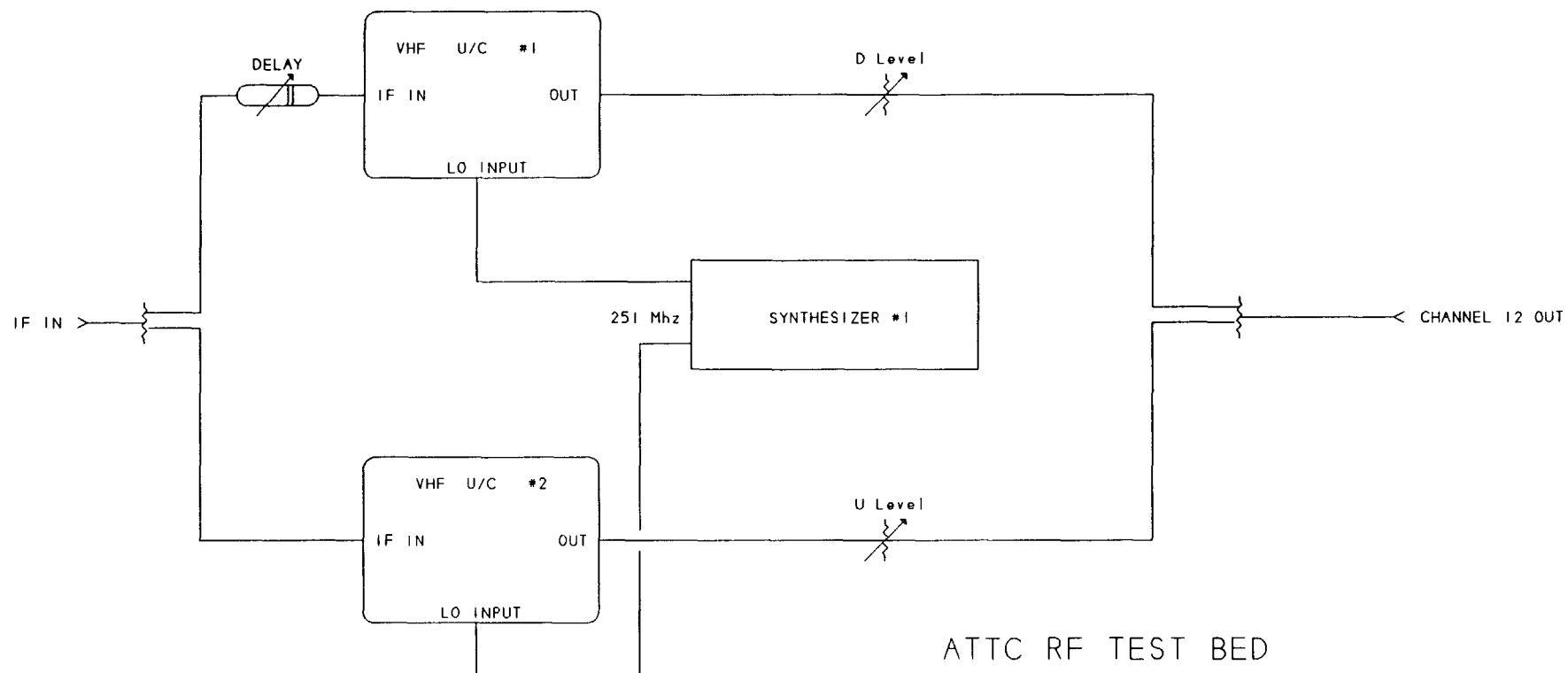
Reduce the noise in both channels by 3 dB. Holding the noise level in the main channel constant, increment the noise level in the augmentation channel, in 1-dB steps, through a level that is 12 dB above the threshold level for the augmentation channel.

Increment the noise in the main channel, in 1-dB steps, through the level that is 12 dB above the threshold level for the main channel. At each step, increment the augmentation channel noise throughout the range of 3 dB below to 12 dB above the threshold level for the augmentation channel.

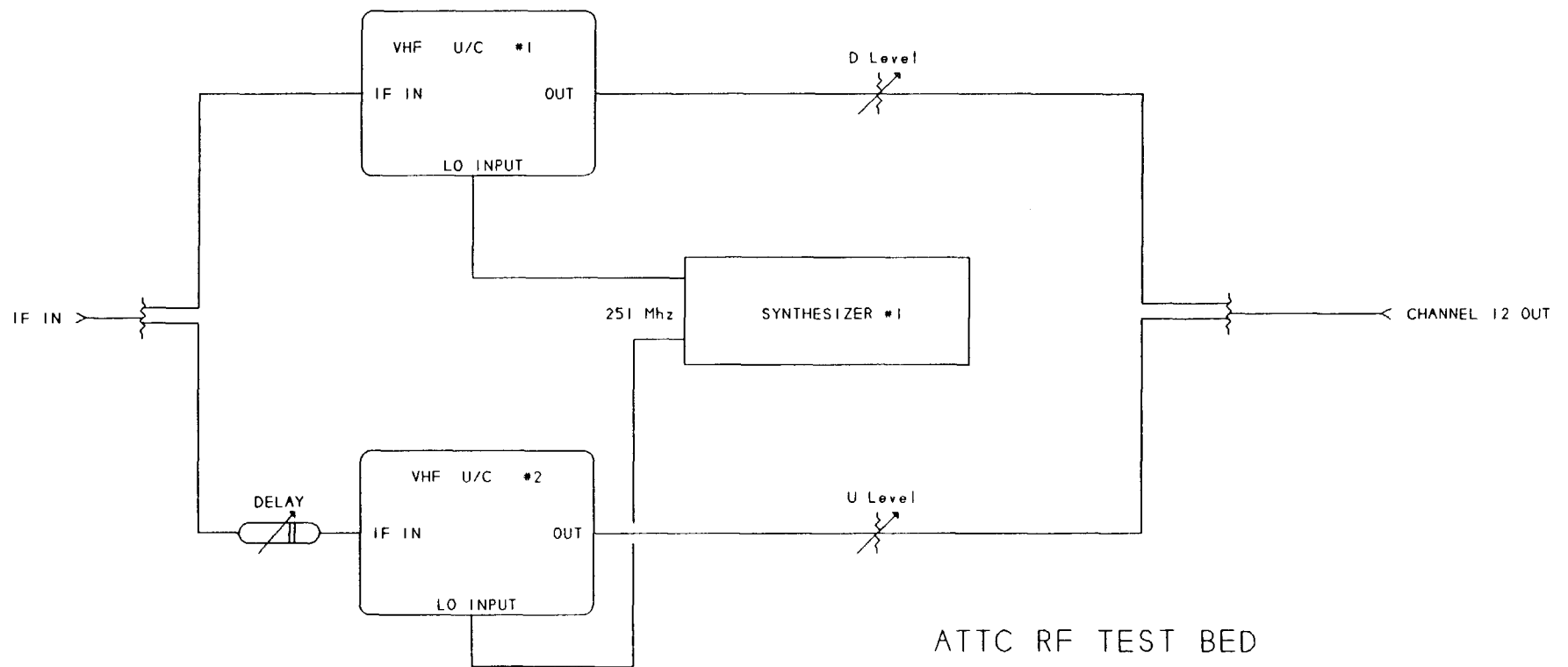
For each step of C/N_0 in the main channel, the expert panel will determine the range of imbalance between the channels, in dB, over which the seam is not perceptible.

19.1.3.3.3 Presentation of Data

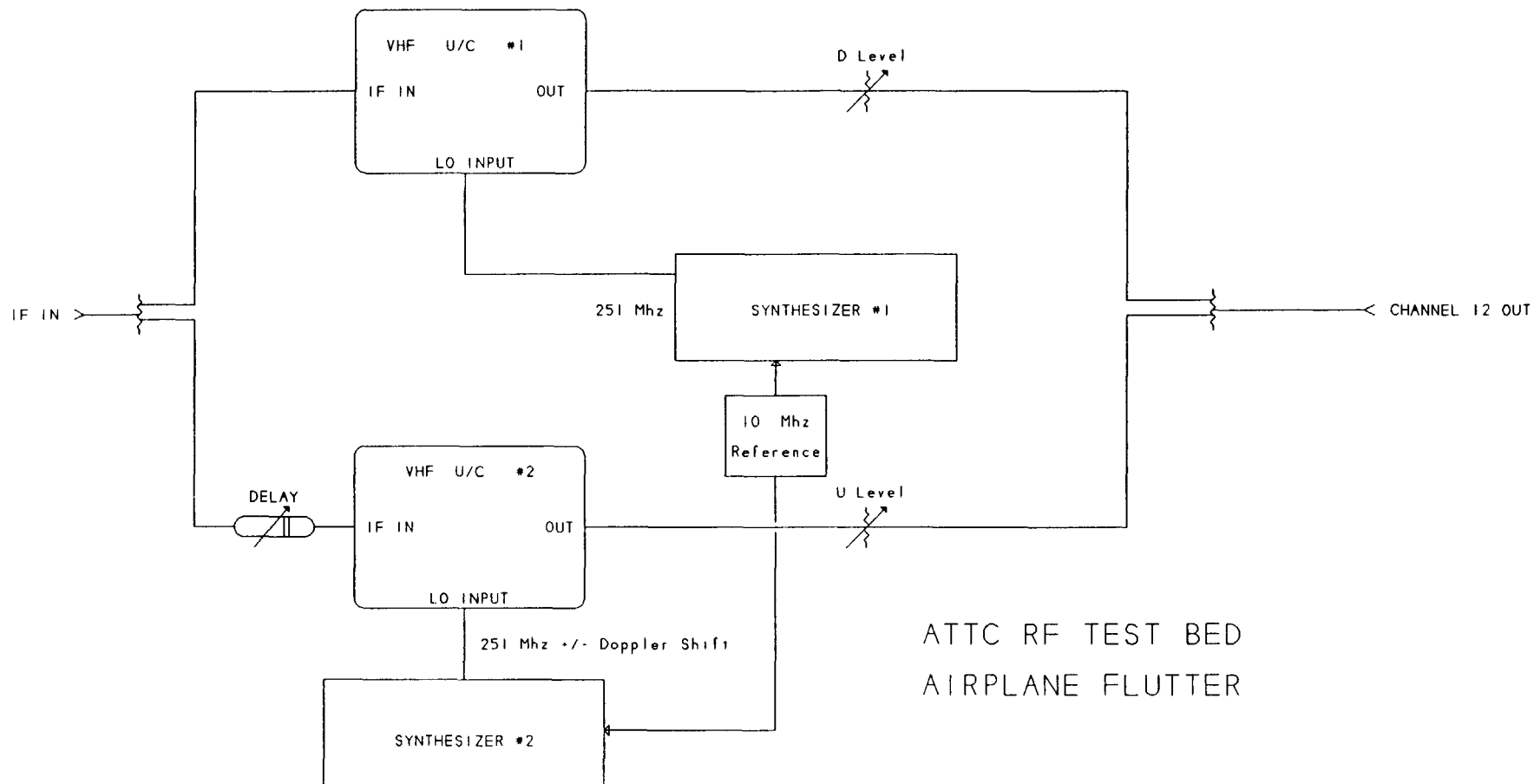
Make a 15-second recording on the HD-DVTR for each combination of main and augmentation channel noise. Document the C/N_0 in each channel, the differential, and the SMPTE time code at the start of each recording. These tapes will be used for archival purposes only. Also photograph the ATV picture monitor for each noise combination.



ATTC RF TEST BED
SINGLE LEADING GHOST



ATTC RF TEST BED
SINGLE LAGGING GHOST



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19.2 Susceptibility to Multipath and Airplane Flutter

19.2.1 Introduction

Multipath is a condition whereby two or more propagation paths exist between the transmitting and receiving antennas. Signals arrive at the receiving point from the different paths at different times, depending upon the lengths of the paths. The effect observed in the received picture is referred to as an echo or ghost.

The indirect paths result from reflections or refractions of the transmitted signal by either natural or man-made surfaces. Natural causes include the atmosphere and mountainous terrain. Man-made surfaces are typically tall buildings in an urban environment. The strength of the echo is a function of the efficiency and size of the reflective or refractive surface and the length of the indirect path.

Multipath may be static or varying. It may be caused by reflection from an airplane, in which case the indirect path length is continuously changing. As the reflected signal from the moving airplane alternates rapidly between in-phase and out-of-phase relationships with respect to the direct signal, a condition called "flutter" results. Some ATV systems may be extremely sensitive to even small but rapid variations of signal level due to flutter.

For NTSC transmission, a path length difference of about 1000 feet results in a horizontal displacement of about two percent of the picture width for the ghost image. A typical ATV transmission system employs a horizontal scanning rate of twice the NTSC rate and has a wider aspect ratio. Hence, for such a system, the ghost image is displaced more than twice as far.

The procedure described below simulates in the laboratory the conditions that produce multipath and flutter in terrestrial transmission paths. The simulated path is interposed between the proponent-supplied modulator and demodulator. Means are provided to combine two identically modulated RF signals, one signal being delayed from the other. The delay is static for echo testing. An artificial Doppler effect, simulating the moving airplane, is achieved by offsetting one carrier frequency from the other by a few Hertz.

19.2.2 Test and Measuring Equipment

The special test equipment required for this procedure includes:

- (1) Two frequency synthesizers operating at approximately 251 MHz. One unit will be operated as the master, and the other as a slave.
- (2) Two up-converters, to generate outputs on Broadcast Channel 12 (204-210 MHz) from IF inputs at either 43 or 45.75 MHz. Local oscillator inputs are at 251 MHz.
- (3) A "trombone" variable delay line, to provide up to 180 degrees of phase shift of the Channel 12 video carrier.

19.2.3 Procedure

19.2.3.1 Setup

Refer to Figures --, --, and -- for functional diagrams of the test setups for this procedure. These setups simulate, respectively, a single leading ghost, a single lagging ghost, and airplane flutter.

For augmented-NTSC systems, the NTSC channel and the augmentation channel are tested individually. The NTSC channel is Channel 12. The augmentation channel is Channel 23.

The ATV outputs of the proponent-furnished decoder are viewed on the reference color monitor and are recorded on an HD-DVTR for any subsequent subjective evaluation by a panel of untrained observers.

The NTSC signal is viewed on receivers and VCRs furnished by EIA/CEG (Section 19.1.1.2) and is recorded on an NTSC-DVTR for any subsequent subjective evaluation.

The video source applied to the proponent-furnished encoder shall be the PIXAR. The test picture shall be the one selected by PS/WP6 for echo testing.

19.2.3.2 Measurement Technique

19.2.3.2.1 Static Multipath

Connect the modulator for the channel being tested to the RF splitter feeding the two Channel 12 up-converters. Connect the other modulator to the Channel 23 up-converter. Set the two 251-MHz

frequency synthesizers so that there is no frequency offset between them.

Determine two types of threshold, visual and data, using the following procedure.

Set the undelayed signal level above the threshold of noise, as determined by the panel of expert observers. Starting at 2.5 microseconds of delay, find the threshold of visibility of a lagging ghost. Adjust the trombone delay line to find the lowest threshold. Increase the echo amplitude, while monitoring the BER, to find the amplitudes at which the BER increases to 10^{-3} and 10^{-4} .

Reduce the delay to 1.25 microseconds, and determine the threshold as before. Continue, reducing the delay in half each time, and determining the threshold at each delay time. The number of steps over which the test is run may be reduced, based upon the judgment of the Test Director.

For low values of delay, the BER may be below 10^{-4} at the visual threshold. In this case, reduce the echo amplitude from the visual threshold to find the BER threshold. If another failure mechanism occurs before the BER threshold is reached (e.g., loss of sync), note the point at which this failure occurs and its nature.

Evaluate the threshold sensitivity to leading ghosts by delaying the "direct" signal by one microsecond and using less than one microsecond in the delaying path. The actual delay of the leading ghost is the difference between the two delays. Repeat the procedure used previously for evaluating lagging ghosts.

At the direction of expert observers, vary the amplitude, delay, and phase to explore any system failures, such as loss of synchronization or color, or the sudden increase in BER.

19.2.3.2.2 Flutter

Connect the modulator for the channel being tested to the RF splitter feeding the two Channel 12 up-converters. Connect the other modulator to the Channel 23 up-converter. Reference one of the frequency synthesizers to the other. Set one of them to precisely

251.0 MHz. Set the other synthesizer to be offset by the selected flutter frequency (i.e., 5 Hz).

Set the attenuator for the echo path to be 15 dB below the direct path, and insert one microsecond of delay into the delayed path. With the guidance of the expert panel, using the ascending/descending technique, find the threshold of visibility of the flutter. Make a DVTR recording at an echo level of 10dB above the threshold level. If system failure occurs at a lower level, make a recording at the highest level possible, and note the level and nature of the failure. Also note the threshold level for sudden increase in BER.

At the direction of the expert observers, and based upon the results of further analysis of the characteristics of airplane flutter, vary the frequency offset between the two synthesizers and the amplitude of the indirect transmission path. Note any combinations of values of these parameters that result in system failure or acute picture impairment.

19.2.3.3 Presentation of Data

Document the equipment settings at which any system failure is observed, and describe the nature of the failure. Examples of failure are loss of sync, loss of color, and the sudden increase of BER.

To the extent that recording of the signals is possible, make recordings on both the HD-DVTR and the NTSC-DVTR showing the impairments documented above. Each recording should be 15 seconds in length and should be logged with the starting SMPTE time code. It is understood that in cases of system failure, such as loss of synchronization, recording may be impossible.

Plot the echo amplitude at the threshold of visibility, at 10^{-4} BER, and at 10^{-3} BER, versus delay time. Figure -- is an example of the presentation format for the data.

Test Date: _____

ATV offset: _____

Video Tape No. _____

Test Data Accepted by: _____

ATV System: _____

NTSC offset: _____

Time Codes: _____

Test Engineer: _____

THRESHOLD OF INTERFERENCE (PICTURE)

	NTSC (U) Into NTSC (D)	NTSC (U) Into ATV (D)	ATV (U) Into NTSC (D)	ATV (U) Into ATV (D)	BER = 10 ⁻⁴		BER = 10 ⁻³	
					NTSC Into ATV	ATV Into ATV	NTSC Into ATV	ATV Into ATV
1. Co-Channel D/U								
2. Upper Adj. Ch. D/U								
3. Lower Adj Ch. D/U								
4. UHF Taboos:								
n+15								
n+14								
n+7								
n+4								
n+2								
n-2								
n-8								

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EXAMPLE OF DATA PRESENTATION FORMAT FOR ALL INTERFERENCE TESTS

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19.3 Susceptibility to Interference

19.3.1 Introduction

Interference may be caused by other television transmissions or by other radio services. The most important type is co-channel interference, since it is a linear interference for which receiver selectivity offers no relief. In the case of co-channel interference, the undesired (U) signal is always smaller than the desired (D) signal. The ratio of signal levels, or field strengths, is expressed as D/U. Other television interferences include adjacent channel (upper and lower), and UHF taboos. In these cases, when the interference is visible, the undesired signal is larger than the desired signal, so the D/U ratio, expressed in dB, is negative. Usually, adjacent-channel and UHF taboo interference results from a nonlinear effect that occurs in the tuner of the television receiver. Hence, receivers will vary in their immunity to these types of interference. Nonlinear distortions must be tested over a range of desired signal levels. The UHF taboos for image response are linear, but the effects will vary greatly among receivers. It is necessary to test image taboos at more than one level of D, in order to avoid noise masking at a particular level. For all testing of co-channel, adjacent-channel, and taboo-channel interference, three levels will be used: -15 dBm, -35 dBm, and -55 dBm. The first of these is above the level at which the AGC of the receiver has an effect. The -35 dBm level is within the range of AGC action. The lowest level is below that at which AGC is effective. Use of these three levels also will permit comparison of the results of this testing with those of previous testing by the FCC.

The FCC allocation rules are based upon the well-known characteristics of NTSC. A proponent system that is "NTSC-like," having only the familiar video and audio carriers and the color subcarrier in the familiar places, would be expected to have similar characteristics. Some proposed ATV systems require, in addition to a main channel that is NTSC-compatible, an augmentation or simulcast channel to provide the enhanced video and audio information. This second channel may employ encoding or modulation schemes quite different from NTSC. Working Party 3, on Spectrum Utilization, of the ATS Planning Subcommittee has determined that, if all U. S. broadcasters were to be assigned an additional 6-MHz channel, the minimum co-channel spacing would be 160 kilometers. At this spacing, a D/U ratio of 6-12 dB would produce interference conditions similar to those that exist for a ratio of 20-28 dB along the Grade B contour of the existing allocation plan. (In each case, the smaller ratio applies when precision offset, rather than normal offset, is used.)

Interference testing has two primary objectives. The first is to measure the **robustness** of a system, the ability of the system to reject interfering signals. The second is to determine the degree to which the proponent system is **benign**, compared to NTSC.

The robustness of the proponent system shall be tested with respect to both an interfering NTSC signal and another identical ATV signal. Since it is expected that only one set of hardware will be available for each proponent system, the second ATV signal for this test must be obtained by delaying the original signal. This imposes certain limitations on ATV-into-ATV interference tests. In particular, the test picture must be prepared carefully to permit this type of testing. The picture must include a flat gray area where interference thresholds may be determined readily. The undesired signal must be delayed for this test. Comprehensive interference testing requires movement in the picture.

Interference may arise not only from other television signals but also from strong discrete-frequency signals, usually from other radio services. The frequencies to which an NTSC transmission are particularly sensitive are those close to the visual or aural carrier or color subcarrier. A graph of just-perceptible carrier-to-interference ratio (C/I) versus interference frequency, for NTSC, follows a so-called "W-Curve." For reference, this curve is depicted in Figure __. The test for robustness of the proponent ATV system shall include exploration for discrete-frequency sensitivities, which are expected near carrier frequencies.

First, the degree to which the ATV system is benign shall be tested using the proponent-supplied encoder and modulator, for the undesired signal, and both the proponent receiver and an assortment of NTSC receivers and VCRs. These NTSC units shall be furnished by EIA/CEG, as explained in Section 19.1.1.2.

The expert observer panel shall determine the threshold of visibility of a given interference for the case of NTSC-into-NTSC. Then, the ATV signal will be substituted for the interfering NTSC signal. The degree to which the ATV signal is benign, compared to NTSC, will be determined by finding the threshold at which the ATV signal causes interference to NTSC. The result to be recorded is simply the difference between the two threshold powers that have been measured.

Then, the ATV signal will be substituted for the desired NTSC signal, and the undesired signal will be, once again, the NTSC signal. The robustness of the ATV signal will be determined, with respect to NTSC, as the difference in interfering power levels at the threshold of visibility.

Finally, an ATV signal will be both the desired signal and the undesired signal, to find the ATV-into-ATV threshold. The test picture carried by both ATV channels will be the same. It contains a large, flat gray area where the threshold of visible interference can be detected readily. The interference will come from parts of the test picture having strong detail, high contrast, and perhaps highly saturated colors. Since ATV systems may generate more interference when there is movement in the picture than for static images, a videotaped motion sequence shall be used. The specific sequence shall be recommended by PS/WP6.

To detect the threshold of interference, the desired signal will be a 50-IRE flat gray field, as recommended by PS/WP6. The undesired signal is a still picture, motion sequence, or test pattern suitable for the purpose, and is selected by PS/WP6.

19.3.2 Test and Measuring Equipment

The equipment used in these procedures is shown in Figure __. The synthesizers must cover the range of 200 to 820 MHz. The up-converters must cover the high-band VHF and the UHF broadcast channels. The up-converter outputs will be filtered according to the specification provided in Figure __.

19.3.3 Procedures

19.3.3.1 Setup

19.3.3.1.1 ATV/NTSC

The degrees to which the proponent ATV signal is robust and benign, with respect to an NTSC signal, are tested using the setup shown in Figure __. Switches alter the configuration of this basic setup, to provide for calibration and to establish the four pairs of desired/undesired signals for testing, as tabulated below.

TABLE 19.1

<u>SETUP</u>	<u>UNDESIREED SIGNAL</u>	<u>DESIRED SIGNAL</u>
REFERENCE	NTSC (matrix)	NTSC (flat field)
NTSC-1	NTSC (matrix)	ATV Main*
NTSC-2	NTSC (matrix)	Augmentation (TBD)
NTSC-3	ATV Main*	NTSC (flat field)
NTSC-4	Augmentation (TBD)	NTSC (flat field)

- * "ATV Main" denotes the main signal of an Augmented-NTSC system, or the single signal of an Enhanced-NTSC or Simulcast system.

For the reference setup, use as the undesired NTSC video source a matrix pattern, or "multi-pattern," that incorporates a variety of standard luminance and color test signals, such as crosshatch, checkerboard, multiburst, and color bars. Use a flat-field test signal, of 50-percent amplitude, for the desired NTSC video. Test signals suitable for augmentation systems are to be determined.

For the subsequent ATV/NTSC tests, use the multi-pattern as the undesired video source, and use the flat field as the desired video. Based upon analysis of a given proponent system by SS/WP1, SS/WP2 may recommend the test pattern to be used for the undesired ATV video signal, in order to test under the condition of maximum RF power. Such a test pattern shall be chosen from the gamut available in the ATTC facility.

For testing, apply pseudo-random digital data to all digital audio (and ancillary data inputs). Apply a random noise or tone test signal to all analog audio inputs of the undesired signal. The analog audio channels of the desired signal should be silent. (Or, they should carry a just-detectable tone to validate normal operation. Channel noise may suffice.) If the audio subsystems have not been implemented, then monitor the BER of the digital channel that has been provided for their future implementation.

When an NTSC signal is the undesired signal, set the aural carrier power of that signal to 20 percent of the visual carrier power. When

an NTSC signal is the desired signal, set the aural carrier power of that signal to 10 percent of the visual carrier power.

In each case that involves the augmentation channel; i.e., Setups NTSC-2 and NTSC-4, both upper (Hi) and lower (Lo) halves of that channel shall be tested if the proponent system is designed with a half-bandwidth augmentation channel.* Six separate test conditions result.

* **NOTE: The proponent must represent that both halves of the augmentation channel are usable. Generally, the upper half of the lower adjacent channel and the lower half of the upper adjacent channel may not be usable.**

TABLE 19.2

<u>TEST</u>	(Un- <u>Desired</u>)	(<u>Desired</u>)	(Un- <u>Tested</u>)
REFERENCE	NTSC	NTSC	---
NTSC-1	NTSC	ATV Main	Augment.
NTSC-2a	NTSC	Augment. Lo	ATV Main
NTSC-2b	NTSC	Augment. Hi	ATV Main
NTSC-3	ATV Main	NTSC	---
NTSC-4a	Augmentation Lo	NTSC	---
NTSC-4b	Augmentation Hi	NTSC	---

The terminology and test signals, associated with Table 19.1, also apply to Table 19.2.

The specific broadcast channels, on which the up-converters should operate, depend upon the prohibited relationship for which each procedure is designed.

19.3.3.1.2 ATV/ATV

The degrees to which the proponent ATV signal is robust and benign, with respect to another identical ATV signal, and between the main and augmentation channels of the same system, are also tested using the setup in Figure __. Switches alter the configuration, corresponding to the four pairs of desired/undesired signals tabulated below.

TABLE 19.3

<u>SETUP</u>	<u>UNDESIRE SIGNAL</u>	<u>DESIRED SIGNAL</u>
ATV-1	ATV Main (delayed)	ATV Main
ATV-2	ATV Aug. (delayed)	ATV Main
ATV-3	ATV Main (delayed)	ATV Augmentation
ATV-4	ATV Aug. (delayed)	ATV Augmentation

For all of the ATV/ATV tests, use the multi-pattern as both the undesired video source and the desired video source. (The undesired signal is delayed with respect to the desired one in order to observe the interference.) If another pattern has been recommended by SS/WP2 for the system under test, use that pattern for supplemental testing.

For calibration and for testing, apply pseudo-random digital data to all digital audio and ancillary data inputs. Monitor the BER under all test conditions.

In each case that involves the augmentation channel; i.e, Setups ATV-2 through ATV-4, both upper (Hi) and lower (Lo) halves of that channel shall be tested if the proponent system is designed with a half-bandwidth augmentation channel. (See Note in Section 19.3.3.1.1, above.) Nine separate test conditions result.

TABLE 19.4

<u>TEST</u>	(Un- <u>Desired</u>)	(Desired)	(Un- <u>Tested</u>)
ATV-1	Main	Main	Augmentation
ATV-2a	Aug Lo	Main	Augmentation
ATV-2b	Aug Hi	Main	Augmentation
ATV-3a	Main	Aug Lo	Main
ATV-3b	Main	Aug Hi	Main
ATV-4a	Aug Lo	Aug Lo	Main
ATV-4b	Aug Hi	Aug Lo	Main
ATV-4c	Aug Lo	Aug Hi	Main
ATV-4d	Aug Hi	Aug Hi	Main

The specific broadcast channels, on which the up-converters should operate, depend upon the prohibited relationship for which each procedure is designed.

19.3.3.2 Measurement Technique

Perform each of the following procedures for each of the seven ATV/NTSC setups and the nine ATV/ATV setups described above, unless the specifications for the system under test obviate the need to test with certain setups. Systems having either no augmentation channel or a full-bandwidth augmentation channel are tested using only those setups that are appropriate to the system.

Approximate synthesizer frequency settings, within given broadcast channels, are specified in each procedure. The exact frequencies to be used depend upon the carrier frequencies, in the vicinity of 44 MHz, that are applied to the proponent modulators. The proponent shall specify the carrier frequencies to be used. In the case of a half-bandwidth augmentation channel, the carrier is switched between two frequencies ("Hi" and "Lo") for different test setups.

19.3.3.2.1 Co-Channel Interference

For this test, both the desired signal and the undesired signal occupy the same broadcast channel. A second channel is used for the augmentation signal, when the main channel is being tested as the

desired channel, or for the main signal, when the augmentation channel is under test.

Co-channel interference visibility is a function of the carrier frequency offset between the interfering transmitters. To accommodate triangular co-channel relationships in the U.S., NTSC co-channel allocations by the FCC are based on carrier frequency offsets of $\pm 2/3 f_H$, ± 500 Hz. Tests have shown that this reduces NTSC co-channel interference visibility by 17 dB. If the carrier offset frequency is maintained within ± 1 Hz, then an additional 6-8 dB in protection can be obtained. (See CCIR Rep. 655.) The interference visibility reduction is due to the integration by the eye of out-of-phase (or partially out-of-phase) interference components on a line-to-line and field-to-field basis.

The proponent shall declare the co-channel carrier offset frequency to be applied to his ATV system. Tests of co-channel interference, NTSC-into-NTSC, then shall be carried out on the corresponding basis. If the proponent has no offset specification, then the nominal frequency for all carriers shall be used, with a tolerance of ± 1 Hz. The exact carrier frequencies used shall be recorded to a resolution of 1 Hz.

Select Channel 12 for the NTSC signal(s) and for the ATV channel. Tune the appropriate synthesizers to approximately 251 MHz. Use appropriate carrier offsets, as specified by the proponent. Select Channel 23 for the ATV augmentation channel for all tests. Tune the appropriate synthesizer to approximately 571 MHz. Tune Synthesizers 1 and 2 to the same frequency, or to the frequencies specified by the proponent for carrier offset, for these co-channel interference tests.

Execute the following steps to determine interference signal levels:

- (1) With the undesired signal at maximum attenuation, adjust the RF amplitude of the desired signal to -55 dBm, as measured at the receiver input.
- (2) Increase the RF amplitude of the undesired signal to the threshold of visibility of the interference, as determined by expert observers. Use the ascending/descending method to determine the threshold. Note the signal amplitude, as measured at the receiver input with the desired signal temporarily fully attenuated.

- (3) With the desired signal restored, increase the undesired signal amplitude to the "crash point" of the system, the level of interference at which the received signal becomes unusable due to synchronization errors, and/or a digital bit-error rate that suddenly increases, or other such criteria as judged by the expert observers. Note the undesired signal amplitude. The method of determining this amplitude is under study; it is primarily a matter of receiver performance characterization.
- (4) Decrease the level of the undesired signal to 2 dB below the previously-determined threshold of visibility, using the calibrated attenuator.
- (5) The two levels of the undesired signal, that were noted in Steps 2 and 3 above, determine the range over which the subsequent subjective evaluation will be performed. Prepare DVTR recordings, for use in that evaluation, by incrementing the undesired signal level in 2-dB steps, over the range from 2 dB below the threshold of visibility to the crash point. Make a 15-second recording at each attenuator setting, and note the SMPTE time code at the start of each recording.
- (6) Repeat Step 1, adjusting the desired signal to -35 dBm. Then, repeat Steps 2 through 5.
- (7) Repeat Step 1, adjusting the desired signal to -15 dBm. Then, repeat Steps 2 through 5.

19.3.3.2.2 Adjacent Channel Interference

For this test, the undesired signal occupies a channel that is adjacent, in either direction, to the one occupied by the desired signal. The notations " $n - 1$ " and " $n + 1$ " may be used to designate the lower and upper adjacent channels, respectively, where " n " designates the channel occupied by the desired signal.

Execute the following steps:

- (1) NTSC, as the desired signal, is on Channel 12 with a 50-IRE flat-field signal, modulated according to FCC specifications. The

peak-of-sync carrier level, measured at the input to the NTSC receivers, is set, in turn, at -55 dBm, -35 dBm, and -15 dBm. The undesired signal is, first, on Channel 11 ($n - 1$) and, then, on Channel 13 ($n + 1$), modulated with color bars. The two sync generators are not locked. At each of the three carrier levels, for the desired signal, and on each of the two channels, for the undesired signal, adjust the RF level of the undesired signal to find the threshold of visibility of the interference, the level at which the digital BER increases to 10^{-4} , and the level at which the BER reaches 10^{-3} . Using the ascending/descending method, four of the five expert observers must concur on the threshold of visibility. Record the RF level at the threshold of visibility, and measure the BER of the digital channel at this level. Also record the RF levels corresponding to BERs of 10^{-4} and 10^{-3} . A suggested format for this documentation is shown in Figure --.

- (2) According to the type of system being tested, execute the appropriate step(s) below:
 - (a) To test an Enhanced-NTSC system, replace the desired NTSC signal on Channel 12 with the enhanced-NTSC signal, modulated with a flat field. Measure the power level of this signal, at the peak of sync, at the input to the proponent-furnished demodulator. With these modifications, repeat the procedure of Step 1.
 - (b) To test a Simulcast system, replace the desired NTSC signal on Channel 12 with the simulcast signal, modulated with a flat field. Measure the power level of this signal, using the method specified by the proponent, at the input to the proponent-furnished ATV demodulator. With these modifications, repeat the procedure of Step 1.
 - (c) To test the NTSC channel of an Augmented-NTSC system, replace the desired NTSC signal on Channel 12 with the NTSC signal from the proponent-furnished modulator, modulated with a flat field. Measure the power level of this signal, at the peak of sync, at the input to the proponent-furnished demodulator. Place the untested augmentation signal on Channel 23. With these modifications, repeat the procedure of Step 1.

- (d) To test the augmentation channel of an Augmented-NTSC system, replace the desired NTSC signal on Channel 12 with the augmentation signal, modulated with a flat field. Measure the power level of this signal, using the method specified by the proponent, at the input to the proponent-furnished ATV demodulator. Place the untested NTSC signal on Channel 23. With these modifications, repeat the procedure of Step 1. If the proponent system uses a 3-MHz augmentation signal, repeat the procedure to test both upper-half and lower-half utilization of the augmentation channel. (See Note in Section 19.3.3.1.1, above.)
- (3) Return the NTSC flat-field signal to Channel 12 as the desired signal. According to the type of system being tested, execute the appropriate step(s) below:
- (a) To test an Enhanced-NTSC system, replace the undesired NTSC signal on Channel 11 or Channel 13 with the enhanced-NTSC signal, modulated with color bars. With this modification, repeat the procedure of Step 1.
 - (b) To test a Simulcast system, replace the undesired NTSC signal on Channel 11 or Channel 13 with the simulcast signal, modulated with the multi-pattern. Measure the power level of this signal, using the method specified by the proponent, at the input to the proponent-furnished demodulator. With these modifications, repeat the procedure of Step 1.
 - (c) To test the NTSC signal of an augmented-NTSC system, replace the undesired NTSC signal on Channel 11 or Channel 13 with the NTSC signal from the proponent-furnished modulator, modulated with color bars. Measure the power level of this signal, at the peak of sync, at the input to the proponent-furnished demodulator. Place the untested augmentation signal on Channel 23. With these modifications, repeat the procedure of Step 1.
 - (d) To test the augmentation channel of an augmented-NTSC system, replace the undesired NTSC signal on Channel 11